Forest Types of Michigan

MICHIGAN STATE UNIVERSITY | Extension

SILVICULTURAL SYSTEMS

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White ash in a managed woodland

"Silviculture" is the art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis. It's also the heart of forest management. A silvicultural system is a planned series of treatments for tending, harvesting, and re-establishing a forest stand.[1] Forest management is a broader term that includes a suite of biological, social, and economic factors.

For the forest owner, the terms may be interchangeable when a forest management plan is developed. For Michigan forest types, there are three major silvicultural systems that are employed. Each system has a number of variations to accommodate the constraints of a particular woodland, desires of an owner, and market conditions in a particular region.

Table 1. Silvicultural Goals and Systems

Silvicultural Goals

1. Provide for forest regeneration.
2. Forest products for the good of the owner and society.
3. Improve the quality and health of the forest.
4. Satisfy the desires of the forest owner

Silvicultural Systems

1. Selection System
2. Shelterwood System
3. Clearcutting System

Foresters will sometimes use terms that forest owners may not fully understand, or apply them in unusual ways. When working with a forester, be sure to ask questions and obtain explanations. The forester will expect this and will be happy to provide clarification. The book "The Forests of Michigan" offers a good chapter on silvicultural background.[2]

A reasonable silvicultural system will meet at least two of the four goals in Table 1, without compromising one or the other. In Michigan, three broad categories of silvicultural systems are common.

Different forest types will respond differently to each silvicultural system. Each system will be appropriate for certain forest types and not so much for others (Table 2). A forest type is a distinct association of tree species, distributed across a wide geographical range. For example, "northern hardwoods" is a common forest type. Thousands of northern hardwood "stands" occur throughout the range of the northern hardwood forest type. Ecological characteristics, along with the socio-economic environment, and forest owner wishes will determine the best fit of a silvicultural system. Consequently, there is a lot of wiggle room to define "what is best" for any particular forest type and forest stand.

Selection System

This is, perhaps, the most commonly applied silvicultural system in Michigan, and is the most commonly misapplied. Individual trees are marked for removal in a commercial harvest. The remaining trees will benefit from the treatment, increasing the overall quality of the stand. The increase in light to the forest floor will encourage tree regeneration.

Two common variations of the selection system exist; single tree selection and group selection.

Marked trees may be distributed evenly throughout the stand resulting in a uniform density of trees. This is the more classic version of the selection system. Single tree selection tends to create an ecological environment that favors sugar maple, or other shade tolerant species, and enhance the quality of sawtimber. Good quality sugar maple sawtimber typically garners the highest monetary value of all Michigan species.[3]

Group selection removes both single trees and groups of trees, resulting in a more variable stand density. The gaps created by harvesting groups of trees encourage greater tree species diversity. Gaps are often created around or next to certain tree species, such as white pine, hemlock, or yellow birch, to favor regeneration of those species. Group selection resembles natural disturbance of these forest types.

A variant of the selection system is called "crop tree selection" in which harvest is designed to maximize growth on preferred trees within a stand. It is often applied to even-aged pole-size stands in which all trees are approximately the same size. Certain "crop trees" are identified, based on their species, quality and spacing. Important crown competitors are removed to provide growing space for the designated crop trees.

Selecting trees for removal generally follows a priority list (Table 3). Priorities might vary with the particular stand and specific desired outcomes. The eventual outcome produces an all-aged or multi-aged stand structure of increasing quality and health.

While the selection system will achieve marvelous results under the right circumstances, forest owners should be aware of similar practices incorrectly called "selective" cutting. The practice of "high-grading" is the removal of the high monetary value trees and leaving the rest without regard for future stand conditions.

Table 2. Some examples of applying different silvicultural systems

Selection System	Shelterwood System	Clearcutting System
Northern hardwoods, high quality	Oak	Aspen
Spruce-fir	Paper Birch	Oak
Black ash on good sites	White pine	Pines (white, red, jack)
Lowland hardwoods on good sites	Spruce-fir	Spruces (white, black)
	Northern hardwoods	Low quality hardwoods

This is generally regarded as poor forestry because repeated applications inevitably lead to poor-quality stands. Another example is diameter-limit cutting, in which all trees above a certain diameter are cut. This is another form of high-grading that also leads to poor quality stands. Partial cutting is sometimes done in inappropriate forest types, such as aspen, where it leads to degradation of stand quality and results in poor regeneration.

Selection system silviculture requires the greatest amount of knowledge and experience. Working with a consulting forester is highly recommended (see MSU Extension bulletin E-3188).

Shelterwood System

This even-aged system involves the harvest of all mature trees in a two or three stage process over several years. Additionally, some stands might be commercially thinned one or more times before they reach maturity. If regeneration is not present, then a portion of canopy trees are harvested to increase the amount of light to the forest floor and encourage regeneration. A ground treatment might be required to expose mineral soil or remove undesirable competing vegetation. The next cut, or first cut if regeneration is already present, removes most of the overstory and provides light to increase the growth rates on understory regeneration. Partial shade modifies the micro-environment to avoid excessive heat and dry conditions. Remaining mature trees are those that are windfirm and of good quality that will rapidly increase in size and monetary value. When the next generation of trees reaches an appropriate size, maybe 6-8 feet high, then the residual overstory is removed.

Oak Shelterwood

In Michigan, shelterwood silviculture is most often applied to oak stands but can be applicable to other forest types as well.

Clearcutting System

Clearcutting is the complete, or nearly complete, removal of a mature stand and is a legitimate system when appropriately applied. Forest types that require full sunlight and warm soil temperatures for regeneration and subsequent growth require this sort of disturbance. In nature, catastrophic events such as wildfire and windstorm provide the necessary ecological regeneration conditions. Classic example forest types are aspen and jack pine.

Seed-tree silviculture is a variation of clearcutting. A small number of trees can be left on-site to provide a seed source. This is sometimes done with white pine, red pine, or oak. Leaving a few trees may also provide benefits for visual quality and certain species of wildlife (such as raptor roosts and snags for cavity nesters). Residual trees must be windfirm and have the ability to adjust to rapidly increased exposure to the sun.

Silvicultural clearcutting (as opposed to other clearcutting) harvests trees at the right time, before over-maturity, to guarantee the optimum amount of vigorous regeneration. The new stand is even-aged and requires few additional practices until the next harvest. The key to the appropriate application of clearcutting is the timing in order to produce the next forest stand.

Table 3.
Sample Marking Removal Order

1. High risk trees
2. Highly defective trees
3. Trees with poor form
4. Crown position/favor crop trees
5. Tree diameter

The order of removal will vary with stand condition and landowner objectives.

Marking A Tree

Wildlife Impacts

Most forest owners rank wildlife values much higher than either timber or revenue.[4] Forest management is a valuable tool to achieve wildlife habitat goals, as well as timber and revenue. Some habitat management practices are difficult to employ without forest management. For example, aspen thickets for woodcock and ruffed grouse require clearcutting aspen at the right time and in a manner that will attract logging contractors. As another example, bird-watchers will see more of certain migratory bird species if the woods has a good understory of shrubs and young trees. This condition is best met through forest management and commercial harvest.

It is important to note that any forestry practice, even a poorly applied one, will benefit some wildlife species and discriminate against others. The complete lack of forest management will also have "winners" and "losers". And, habitat conditions change over time, with or without management, and these changes will impact wildlife use. Oftentimes, "wildlife" is meant to be "game species," more specifically white-tailed deer. However, there are nearly 600 species of vertebrates that occur in Michigan. Most of them depend upon forests for at least part of their habitat requirements but specific forest conditions are far from equal when looking at the needs of any particular species of wildlife.

See http://michigansaf.org for Forest Management Guidelines from the Michigan Society of American Foresters.

[1] Definitions from Helms, John A. 1998. **The Dictionary of Forestry**. The Society of American Foresters.

[2] Dickmann, D.I. and L.A. Leefers. 2003. **The Forests of Michigan**. University of Michigan Press.

[3] Recent historical values from DNR stumpage reports and TimberMart North reports.

[4] Butler, B. 2006. **Family Forest Owners of the United States**. USDA Forest Service General Technical Report NRS-27.